United States
Office of Personnel Management

FWS Job Grading Standard for

Model Maker

4714

Human Resources Systems Service
Office of Classification
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NOTE

This standard has been converted from the original paper format to electronic format without substantive change in series coverage or grading criteria. The standard was reviewed to correct errors that may have been introduced during the conversion process. In some standards minor corrections were made such as updating references to other documents that may have become obsolete, or correcting minor typographical errors in the original standard. Any errors that remain due to conversion to electronic format should be minor and are not intended to change the meaning of the original standard.

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WORK COVERED

This standard is used to grade all nonsupervisory jobs involved in planning and fabricating complex research and prototype models which are made from a variety of materials and are used in scientific, engineering, developmental, experimental, and test work.

TITLES

Jobs graded by this standard are to be titled Model Maker.

GRADE LEVELS

This standard describes two levels at which jobs might be established. If jobs differ substantially from the skill, knowledge, and other work requirements described in the grade levels of the
standard, they may warrant grading below these grades.

NOTES TO USERS

During the factfinding study for this occupation, certain characteristics were found to be consistent even though agency and installation grading practices differed considerably. These characteristics form the frame work of the job grading standard. They are emphasized in this section to assist in identifying the occupation in contrast to other, similar work, and are intended to reinforce the information in the factors as described in the body of the standard.

Most model makers were found to be working in organizational units that provided service to research and development activities. Some jobs were found in other shops (for example, machine shops and woodworking shops) that primarily service other functional areas such as manufacturing or maintenance. The jobs in the model shops were usually identified as model makers at a variety of levels of the Federal Wage System (FWS) grade structure. Jobs in other shops were usually identified as premium jobs in a single trade (for example, Machinist, grades 12 or 13). While both of these arrangements may be satisfactory for grade level purposes, comparisons are provided to assist in distinguishing the characteristics between the model maker and jobs in other occupations of the FWS.

Jobs that substantially match the characteristics in column A, below are model makers regardless of the organizational location of the position.

Jobs that substantially match the characteristics in column B, below are more appropriately considered as premium jobs in a specific trade regardless of their organizational location.

These jobs are to be classified by closely comparing them with the grade levels described in the

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appropriate job grading standard to determine whether thee match or exceed the skill and knowledge outlined in the standard and by interpolation between these standards and the one for the model maker.

These jobs are to be titled to the occupation that includes the single trade work processes.

A. **MODEL MAKER**	**B.** **PREMIUM JOURNEYMAN**
1. The work processes used to make items require the skill and knowledge of more than one specific trade; for example, the worker uses work processes of (a) machining, welding, and metal surface treating; or (b) metal working and electronics. While the worker does not need the skill to perform all the work processes in the broad trade areas, he must have sufficient knowledge of them to establish the requirements for other tradesmen to follow and to accept or reject their work.	1. The work processes used to make the item require skill and knowledge of a single trade; for example, Machinist, Toolmaker or Sheet Metal Worker. The worker has the skill to perform all the work processes. On large, multipart projects, he may assign work to other workers in his trade, check their plans, and provide technical advice and assistance on the work processes.
2. The project requires considerable initiative and imagination in extending and modifying trade work processes and improvising with them in various combinations to manufacture unique and one-of-a-kind items.	2. The project requires a very- high degree of ability to work to critical exactness and precise tolerances. Trade processes are used to the fullest extent or extended beyond that normally expected of a journeyman.
3. Assignments are usually on a project-to-project basis although the worker may be occasionally called on to assistor another project because he possesses expertise in a specialty.	3. Assignments are varied. Because they require the use of the fullest extent of the trade work processes, assignments on some projects may be shared with other trade specialists.
4. After original assignment by the supervisor, the employee works with	4. Although work orders are usually initiated by engineering, professional, or

engineering, professional, or technical personnel for the duration of the project. He consults with his supervisor on principally the most complex trade problems and for administrative purposes.

5. The worker is assigned to and responsible for the end item --the complete model or a complex component of the model.

6. When the assignment is to make a model component, the component is either a complete component item that can operate as a separate unit and is as complex as complete models normally assigned to the shop, or the planning and making of it requires a knowledge of the purpose and use of the model in which the component is a critical item.

technical personnel, work processes are usually approved by the supervisor, especially when trade techniques deviate from normal trade practices.

5. Although the worker may work closely with the work order initiator, completed items are usually approved by a supervisor or an inspector before release.

6. When the assignment is to make a model component, the component is usually recognized as an integral part that must fit precisely but does not usually require the knowledge of the purpose and use of the complete model.

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General: WG-14 level work in the model making occupation involves planning, laying out, fabricating, and modifying research and prototype models which are made from a variety of materials including wood, wood substitutes, and other pliable materials such as plastic, plaster, and light weight metals; or from a variety of ferrous and nonferrous metals; or from a variety of complex electronic and electrical circuitry and components. The models are identified with a single broad category such as mechanical models, or electronic models, and are used for testing in actual conditions or in wind and ballistic tunnels, surface, underwater, and atmospheric conditions, gymnasticators, shock tubes, and other similar research and test facilities.

The WG-14 Model Maker independently plans, constructs, and assembles complete models without detailed instructions or close past precedents. Completed work is reviewed by the supervisor as unusual problems arise; through periodic progress reports from the employee; and through discussions with project engineers, medical doctors, or scientists.

Skill and Knowledge: The WG-14 Model Maker applies a knowledge of a variety of manufacturing processes and methods during the planning stages of a project. He discusses the general idea of a desired item with the work-order initiator (engineer, doctor, or scientist) in terms
of the intended use, operational characteristics, approximate configuration, size, weight, dimensions, tolerances, and the number and kind of assemblies and subassemblies. He makes calculations such as loads, sizes, dimensional fits and weights, using shop algebraic and trigonometric formulas and tables.

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He recommends alternative methods when design characteristics cannot be met by proposed fabrication processes and suggests changes because of unsuitable or unavailable material, unrealistic component alignment or other fabrication requirements in the original design. From the nature of the test, experiment, or intended use of the model, he determines what materials and work methods are best to use and the operational and fabrication processes to follow by considering such factors as strength, desired life, location of component members, surface finish, atmospheric, oceanographic or biological environment, pressure, heat, pitch, yaw, stress, and strain.

The WG-14 Model Maker knows how to plan and lay out complete models, assemblies, and subassemblies; to reproduce scale designs, and to plan work requirements so that other employees assigned to the project can easily follow instructions. For example, a specialist in making metal models must be familiar with the latest production processes to select, cut, fit, and achieve trueness and to fasten and hold several metals together with allowances for desired moving, bending, and oscillating according to design and operational requirements. He must be skilled in using tools such as soldering irons, welding equipment, bonding and brazing equipment, and the full variety of metal working machines including the latest machines such as numerically controlled and electrical discharge machines.

As another example, a specialist in making nonmetal models is skilled in a variety of trade functions such as woodworking, plastic working, sheet metal, and tube working and is able to fabricate, assemble, and align parts and components with critical centerline dimensions. He is skilled in setting up and operating a variety of wood and plastic working machines and apparatus. He knows how to define reference points with compound, three-dimensional configurations
to hold, machine, fabricate, and assemble items with compound curves and intersecting compound angles. He must know the characteristics of a variety of plastics, epoxies, resins, and catalysts to obtain the proper weight and strength of synthetic materials. He shapes and molds them to correct configurations, using the latest forming methods such as vacuum and pressure techniques. Some nonmetal model makers at this level also may plan and fabricate patterns from wood, plastic, and plaster materials to be used in casting metal objects in addition to other wood and plastic fabricating processes.

Another example of work at the WG-14 level is an assignment to plan and construct a complete model from electronic and electrical components, units, and assemblies. For example, the WG-14 Model Maker, specializing in this kind of work, devises and constructs complex circuitry based on the determination of cable and wave guide size, insulation, fuse requirements and other similar needs. He plans, and lays out the chassis and determines the number, type, and placement of
elements such as relays, solenoids, transformers, condensers, tubes, transistors, switches, inductors and motors. He determines the number and type of components needed to produce the required current-carrying capacity, torque, power and other characteristics of the model. He

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assembles units such as indicators, meters, counters, transmitters, receivers, amplifiers, pattern recording equipment and servomechanisms. He makes all connections and completes the model by soldering, riveting, screwing, bolting, or by other similar fastenings. When the components, units, and assemblies are not available from sources of supply, the WG-14 Model Maker fabricates or adapts them from available materials. He checks the operation of the assembled model using
various measuring instruments such as oscilloscopes, bridges, capacitance checkers, analyzers, signal generators, wave inductors, and various types of meters. He also checks the operation of the associated mechanical elements or structural features of the completed model to insure that it meets all the requirements as established by the work order initiator.

The WG-14 Model Maker knows how to develop and fabricate special tools, fixtures, and jigs to hold, machine, fabricate, and assemble items with compound curves and intersecting compound angles. In addition, he is skilled in using a variety of specialized and precise measuring devices such as supermicrometers, shadowgraphs, and a variety of specialized tools and equipment such as electrical discharge machines, jewelers lathes, microsoldering and welding equipment, and a
variety of electronic tools and meters.

Responsibility: The supervisor or designer makes general assignments without detailed instructions on projects typically associated with the development of specialized complex research
apparatus which are new, novel, or without close precedent. The guidelines provided consist mainly of incomplete drawings, photographs, sketches, and oral information related to basic design data without specific details of component relationships, sizes, fits, shapes, or materials (such specific details are developed during the fabrication processes). Researchers depend on the originality and ingenuity of the employee for the solution of fabrication, assembly, installation, and
related problems.

In addition to personally performing the more complex machine and assembly operations, the WG-14 Model Maker assumes the responsibility of a project by planning and coordinating the efforts of other workers on large, multipart, or extended projects. He consults with his supervisor principally on problems such as obtaining required equipment, materials, and manpower. The supervisor reviews the work on only the most complex technical problems and through discussions with technical and professional personnel with whom the model maker is working.

Physical Effort: The WG-14 Model Maker frequently handles objects weighing up to 10 pounds, and occasionally handles objects weighing up to 50 pounds without the assistance of lifting devices. The work involves standing, walking, stooping, bending, kneeling, climbing up
and down ladders and scaffolding, and pulling and pushing at various stages of assignments to assemble items and install assemblies.

Working Conditions: The WG-14 Model Maker works inside in areas that are noisy and dirty; and occasionally outside. He is exposed to the possibility of cuts, bruises, scrapes, burns, and

broken bones. The tasks may involve discomfort while wearing helmets, aprons, gloves, safety glasses, hard hats, and other protective equipment as required by changing assignments.

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General: The WG-15 Model Maker plans, lays out, modifies, and fabricates models that are more complex than those described at the WG-14 level. In contrast to the WG-14 Model Maker whose work involves skill and knowledge of a single, broad occupational area, the WG-15
Model Maker's work involves skill and knowledge of a combination of occupational areas. For example, the WG-15 Model Maker makes models with powered and moving assemblies and the associated instrumentation devices such as electromechanical detection and recording equipment,
strain gage members, survey rakes, optical assemblies, calibrating nozzles, shock tube valves, probes, and gages.

The WG-15 Model Maker is responsible for all the planning and the manufacturing processes whether he personally performs them or is assisted by other craftsmen. This is also typical at

the WG-14 level, but because of the requirement to use skill and knowledge of a wider variety and a greater number of work processes, the WG-15 Model Maker meets and solves more problems that require him to make additional judgments and decisions.

Skill and Knowledge: The WG-15 Model Maker knows how to plan and lay out the most complicated models and to perform or direct the fabrication processes for the complete model. The model represents a broad knowledge of several occupational categories and a variety of design characteristics. For example, based on a thorough knowledge of their characteristics, the WG-15 Model Maker develops the circuitry and determines the need for a variety of electrical or electronic components. After personally fabricating the metal components, he assembles, arranges, mounts, wires the components, makes precision fitting and aligns and tests the complete assembly.

Given the same assignment, another WG-15 Model Maker would assemble and fabricate the electrical and electronic components and plan and direct the fabrication of the metal components of the complete electromechanical model. In either example, the WG-15 Model Maker is responsible for all components of the model, its accuracy, and operating quality.

Other typical models which are assigned to the WG-15 Model Maker require skill in working materials such as steel, aluminum, copper, fiberglass, plastics, ceramics, rubber, fiber, phenolics, and in addition, soldering and welding, cable splicing, harnessing, isolation and miniaturization

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techniques. As another example, the kinds of models assigned to the WG-15 Model Maker require the understanding of optical system design and its related mechanical design principles for
holding and moving optical components without deformation or misalignment and the ability to manufacture, fit, and align all components by machining and assembling parts of the complete model to extremely close fits and tolerances.

The WG-15 Model Maker is skilled in the operation of more of a variety of specialized tools and equipment than the WG-14 Model Maker. For example, he plans and makes special jigs, fixtures, and tools to assist in the machining processes and on the same project he uses a variety of electronic equipment such as volt-ohm meters, frequency meters, audio-oscillators, autocollimators, alignment telescopes, and other similar equipment for testing components and assemblies of the more complicated models. The knowledge of shop mathematics the WG-15
Model Maker uses is more extensive than that used by the WG-14 Model Maker because the design characteristics of the models to be manufactured present problems in broader trade areas. For example, a model with electromechanical features requires the calculation of

various angles and planes and unusual contours and shapes to plan and layout the mechanical components and, in addition, the calculation of load, resistance, capacitance, voltage, and other electrical and electronic mathematical problems.

Responsibility: The supervisor makes general assignments without detailed instruction on projects typically associated with the development of unique and complex research models which are without precedent or closely related work. Guidelines provided consist mainly of oral information related to basic model requirements and environmental conditions.

The WG-15 Model Maker makes unreviewed trade judgments and decisions on how models will be fabricated, including determinations of precise specifications required to achieve the final operating characteristics requested by scientists and engineers. Both researchers and the supervisor depend on the broad experience, originality, and ingenuity of the model maker for the solution of fabrication, practical design, assembly, and installation problems. The WG-15 Model Maker consults with professional instrumentation engineers, and other specialists, on unusually complex and difficult problems which cannot be solved through practical designer fabrication techniques. The supervisor typically reviews work through periodic progress reports from the model maker and through discussions with technical and professional personnel with whom
the model maker is working.

The work at the WG-15 level is more responsible than at the WG-14 level because the more complicated models require more judgments and decisions concerning a greater variety of alternative methods, materials, work sequences, and planning, assembling, and testing techniques.

Physical Effort: Physical effort at this grade level is the same as that described at the WG-14 level.

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Working Conditions: Working conditions at this grade level are the same as those described at the WG-14 level.